REMARKS

Claims 1-8, 13-28, 30, 31, 34-36 and 38-50 remain pending in this application.

Referring to the Office Action, Applicants duly note that Claims 9-12, 29, 32, 33 and 37 have been "withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected species, there being no allowable generic or linking claim."

Referring to the Office Action, claims 1-8, 13-14, and 38-50 stand rejected under 35 U.S.C. 102(b) as being anticipated by WO 00/15548. The Office Action states that with regard to Claim 1, the reference "teaches a composite material comprising carbon fullerenes (used as a binder) sintered and combined in a matrix of Graphite diamond, B, C, TiC, SiC or other ceramic composites (page 13 spec)." The rejection is hereby traversed and reconsideration is respectfully requested.

Although WO 00/15548 does disclose using fullerene-based compounds to produce a nanostructured carbon composite material, the cited reference fails to disclose or suggest the use of mixed fullerenes, which are composed of a disparate mixture of fullerene compounds based on varying molecular weights. The cited reference discloses the use of a starting material comprising "(a) nanotube like (fullerenes), (b) buckyball like (fullerenes), or (c) mixtures of the same with **similar diameters** (one dimension size) of particles of 0.7-7.0 nm." The reference further

teaches that the particles are "separated by a narrow range of diameters." (page 3, line 5) In order to obtain fullerenes of the same diameters, the starting fullerenes must possess the same or substantially the same molecular weights to one another. This is materially different than what is claimed by Applicants.

WO 00/15548 further notes that the physical properties of the new carbon materials depend on the type and purity of the starting fullerenes, and conveys the importance of "utilizing high purity levels in the starting buckyball and nanotube powders" (page 5, lines 20-21). Indeed, the cited reference instructs that the production of the material requires "1) purification of the starting material into at least 99%, and preferably >99.9%, pure carbon material of either C60 or single walled nanotubes...." (see page 3, lines 8-12, and page 6, lines 2-4). The reference specifically includes procedures for sample preparation and compaction that is focused on obtaining pure fullerene C_{60} buckyball powder to produce the carbon material (page 7, lines 1-16). WO 00/15548's use of high purity C_{60} and/or single walled nanotubes as starting material is materially different than what is claimed by Applicants. As will be shown further below, WO 00/15548 teaches away from Applicants' invention as claimed.

In the present invention, Applicants claim a composite material having a nanostructured carbon binder phase derived from a carbon binder mixture comprising mixed fullerenes interspersed throughout the matrix, and a method for making the same using mixed fullerenes. Applicants emphasize that the carbon binder mixture used comprises "mixed fullerenes." The term "mixed fullerenes" is defined in the

Specification on page 17 as "a mixture of fullerenes of varying molecular weights." It is preferred that the fullerenes of the present invention are of varying mass or size (e.g., C_{60}, C_{70}, C_{80}, and so on).

"The use of mixed fullerenes yielded an unexpected result in providing a carbon binder phase that can be converted to a nanostructured carbon material at lower pressures and temperatures than what is required when using highly pure C_{60}, for example" (Specification, page 17, lines 3-5). Furthermore, this discovery substantially lowers the cost for fabricating the composite material by eliminating the necessary step of purifying the starting materials prior to pressure-sintering. Applicants have also discovered that the use of mixed fullerenes allows greater flexibility in control of bonding between the matrix phase and the nanostructured carbon binder phase and improves process scalability at improved economical cost.

Applicants would like to emphasize that the ability to sinter mixed fullerenes at pressures in the range of 0.1 to 1.0 GPa was totally unexpected. Many commercial presses are able to produce pressures in this range. For example, hot isostatic pressing (HIP) is routinely carried out at 0.1 to 0.3 GPa. Accordingly, using mixed fullerenes as the carbon binder phase opens greater opportunities for manufacturing such composite materials on a large scale. This is less feasible for pure C60 fullerenes or pure carbon nanotubes, which require substantially higher pressures of 1.0 to 10 GPa. These high pressure requirements greatly limit scalability.

The use of mixed fullerenes reduces the temperature and pressure required to obtain desirable material properties comparable to a carbon binder mixture containing only a specific fullerene compound of high purity levels, wherein the latter requires pressure-sintering at higher pressure and higher temperature. Although the present invention can be pressure-sintered at higher temperature and pressure ranges, the practicability of implementing the lower end temperature and pressure ranges to obtain a nanostructured carbon material is a surprising discovery.

Accordingly, the starting material of WO 00/15548 is therefore materially different from the present carbon binder mixture comprising mixed fullerenes as claimed by Applicants. In view of the above remarks, Claims 1 and 38 are patentable over WO 00/15548, and in condition for allowance. Claims 2-8, 13-14 are patentable for at least for the same reasons as Claim 1, since each ultimately depends from claim 1. Claims 39-50 are patentable for at least the same reasons as Claim 38 from which each ultimately depends.

Referring to the Office Action, Claims 20-28, 30-31 and 34-36 stand rejected under 35 U.S.C. 103(a) as being unpatentable over WO 00/15548 in view of Nakano et al. (U.S. 4,722,817). The Office Action states that WO 00/15548 discloses the features previously discussed, but fails to disclose the use of fibers. However, the Office Action points out that Nakano et al. teaches the use of "SiC or carbon fiber reinforcement to strengthen ceramic composite materials (column 1 line 37-55)." The Office Action concludes that it would be obvious to one of ordinary skill in the art at the time the

invention was made "to use a fiber-reinforcing additive to reinforced the composite material taught by WO '548." The rejection is hereby traversed and reconsideration is respectfully requested.

Applicants respectfully request reconsideration of the teachings of WO 00/15548 in view of Nakano et al., which on close review by Applicants clearly does not make obvious Applicants' invention as claimed. The remarks made in response to the above anticipation rejection are also applicable herein. As discussed above, WO 00/15548 does not disclose or suggest the use of mixed fullerenes as claimed by Applicants, and teaches away from Applicants' invention.

Nakano et al. teaches the production of continuous carbon fiber reinforced silicon carbide (SiC) composite that consists of continuous carbon fibers and a SiC matrix undergoing multiple treatment steps. The cited reference teaches the coating of continuous carbon fibers with SiC, titanium carbide (TiC), titanium boride (TiB_2), or titanium nitride (TiN), and molding the resulting material in a prescribed shape. The shaped material is then impregnated with a slurry consisting of a mixture of a thermosetting resin, such as phenol resin or furan resin, or a high carbon caking agent with a fine powder of SiC, Si_3N_4, SiO_2 or Si. The impregnated shaped material is then cured and carbonized in an inert gas, and the resulting composite is impregnated with liquid silicon and heat treated in an inert gas at a temperature exceeding 1450°C.

The Nakano et al. reference teaches a silicon binder phase that yields silicon carbide upon processing. Nakano et al.'s binder phase is produced by infiltration of liquid silicon into a carbon-silicon carbide matrix. Nakano et al. does not teach or suggest the use of pressure-sintering where the combination of high pressure and high temperature is used to treat mixed fullerenes. Accordingly, Nakano et al. teaches away from Applicants' invention as claimed.

There is no motivation or suggestion provided in the cited references to provide a composite material having a nanostructured carbon binder phase derived from a carbon binder mixture comprising mixed fullerenes interspersed throughout the matrix as claimed by Applicants. The references, individually or in combination, do not teach the limitations of the claimed invention. Moreover, the starting materials and processes taught by WO 00/15548 and Nakano et al. for producing the final materials are different, and as indicated, teach away from the present invention as claimed.

There is no suggestion or motivation provided that would lead one of ordinary skill in the art to combine the cited references. One of ordinary skill in the art, based on the cited references, therefore could not arrive at the claimed invention and therefore the claimed invention is not obvious. Therefore, Claims 20, 25, and 30 are not anticipated or made obvious by the teaching of the references taken individually or in combination. Accordingly, in view of the above remarks, Claims 20, 25, and 30 are patentable over WO 00/15548 in view of Nakano et al., and thus is in condition for

allowance. Claims 21-24, 26-28, 31, and 34-36 are also patentable for at least the same reasons, since each ultimate depend from either Claims 20, 25, or 30.

Applicants urge that the case law clearly supports the above discussion that the cited references do not make Applicants' invention as claimed obvious, in that the references fail to teach or even suggest the elements of Applicants' invention as claimed. Also, the case law is clear in guarding against the use of hindsight in reading Applicants' invention into the prior art, which art is clearly not disclosing the Applicants' invention as claimed. Applicants now bring the following case to the Examiner's attention:

The Supreme Court in Calmar, Inc. v. Cook Chemical Co., 383 U.S. 1, 86, in which the Court warns the dangers of "slipping into hindsight", citing the case of Monroe Auto Equipment Co. v. Heckethorn Mfg. & Supply Co., 332 F.2d 406, 141 U.S.P.Q. 549 (6th Cir, 1964), where the doctrine is stated:

> We come to the patented device which after all is the subject matter of this case. At the outset we take note of two well-established principles. The first is that in considering the questions of obviousness, we must view the prior art from the point in time prior to when the patented device was made. Many things may seem obvious after they have been made and for this reason, courts should guard against slipping into use of hindsight. We must be careful to "view the prior art without reading into that art the teachings of appellant's invention. Application of Sporck, 301 F.2d 686, 689 (C.C.P.A.).

In view of the foregoing, Applicants submit that the claims as now presented are in condition for allowance and early passage to issue is therefore deemed proper and respectfully requested. Applicants respectfully request that a timely Notice of Allowance be issued in this case.

It is believed that no additional fee is due. However, if any additional fee is due, it should be charged to Deposit Account No. 23-0510.

Respectfully submitted,

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